Do Risk-Taking Incentives Induce CEOs to Invest? Evidence from Acquisitions

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Abstract

This paper examines the effect of risk-taking incentives on acquisition investments. We find that CEOs with risk-taking incentives are more likely to invest in acquisitions. Economically, an inter-quartile range increase in vega translates into an approximately 4.22% enhancement in acquisition investments, consistent with the theory that risk-taking incentives induce CEOs to undertake investments. Importantly, the positive relation between vega and acquisitions is confined only to non-overconfident CEOs subgroup. Further, corporate governance does not generally affect the association between vega and acquisition investments. Finally, vega is positively related to bidder announcement returns.

***JEL Classification*:** G34, J33, M12

***Keywords*:** Executive Compensation, Managerial Incentives, Risk-Taking, Mergers and Acquisitions, Overconfidence

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1. Introduction

The recent theoretical framework of Edmans and Gabaix (2011) predicts that risk-averse CEOs are offered compensation contracts with greater risk-taking incentives which induce them to take on risky projects. However, the empirical evidence is rather contradictory. While Coles et al. (2006) and Gormley et al. (2013) find a positive relation between option-based incentive contracts and risk-taking, Hayes et al. (2012) show mixed results. Motivated by the conflicting empirical evidence on the subject, this study re-examines whether risk-taking incentives induce CEOs to conduct risky investments in the takeover setting. Mergers and acquisitions (M&As) represent major corporate investments with CEOs receiving, very often, lucrative compensation packages (Grinstein and Hribar (2004)). As Harford and Li (2007) argue, acquisition decisions may be the most important corporate resource allocation decisions that CEOs take. Yet, acquisition projects are also investments with uncertain net present value (NPV), which may alter firm's *status quo* and increase risk (Datta et al. (2001)). More precisely, regardless of whether all acquisitions increase firm risk *per se*, acquisitions constitute risky investments as they also expose CEOs to a certain degree of risk. In particular, CEOs might get fired (Lehn and Zhao (2006)) or their firm can become a potential takeover target if the acquisition is bad (Mitchell and Lehn (1990)).[1]

Using M&As to investigate the relation between incentive contracts and investment policy is of paramount interest for two main reasons: First, given the well-documented presence of substantial agency conflicts in M&As (Jensen (1986), Lewellen et al. (1985) and Morck et al. (1990)), corporate takeovers – by far from any other corporate investment – serve as an ideal testing platform to explore the relation between managerial risk-taking incentives and investment

[1] The source of risk (i.e., whether acquisitions increase firm or CEO-specific risk) is beyond the scope of this paper. Our premise is that all acquisitions involve some sort of risk and are therefore risky investments irrespective of where this risk comes from.

decisions. Specifically, increases in risk-linked compensation are in line with the agency theory, which suggests that optimal CEO compensation should align the interests of risk-averse managers with those of shareholders by motivating managers to commit to risk-increasing projects (Jensen and Meckling (1976) and Smith and Stulz (1985)). Second, while many acquisitions enhance bidding firm shareholders' wealth, including CEOs with equity-based compensation, a significant fraction destroys value.[2] Therefore, particularly in M&As, CEOs should be induced with greater risk-taking incentives to make the investment.

In fact, following the seminal work on agency theory by Jensen and Meckling (1976), the central principle of the principal-agent theory is the positive association between risk and incentives (Holmström and Milgrom (1987)); in particular, higher performance pay induces greater effort from the agents but increases the risk on their compensation.[3] Hence, the sensitivity of CEO wealth to stock price, called *delta* in the literature, appears to align managers and shareholders' interests (Jensen and Murphy (1990)). Nevertheless, at the same time delta increases managers' exposure to risk, which might prevent CEOs from some positive NPV projects when they are very risky. In this respect, Smith and Stulz (1985) argue that shareholders can reduce managers' risk aversion to risky but valuable investment–projects by increasing the convexity of the relation between managers' wealth and firm performance using, for instance, options (Guay (1999)). Therefore, the sensitivity of CEO wealth to firm stock return volatility, which we refer to hereafter as *vega*, should induce risky investment choices by CEOs who seek to benefit from an increase in share price volatility. Overall, the aforementioned discussion raises

[2] It is worth noting that US public acquisitions are associated, on average, with negative acquiring firm announcement returns (Moeller et al. (2004)); nevertheless, almost half of the deals (42%) are positive NPV investment projects for a sample of acquisitions over the period 1992-2006. (*The Boston Consulting Group*, July 2007).

[3] Additionally, based on Holmstrom and Ricart i Costa (1986) theoretical model, managers are concerned about the impact of investment decisions on their future careers, which may, to an extent, create a potential misalignment of incentives. Along these lines, a recent work by Eckbo et al. (2014) shows that high personal costs of financial distress provide managers with incentives to hedge against default by choosing less risky investments.

a number of important yet unanswered questions: Do risk-taking incentives induce CEOs to carry out an acquisition deal? What drives the relation between risk-taking incentives and M&As? Do corporate governance mechanisms play a role in the association between risk-taking incentives and acquisition investments?[4] Finally, what is the relation between CEO risk-taking incentives and bidder announcement returns?

This study draws motivation from the conflicting empirical evidence regarding the relation between managerial incentive plans and firm investment policy and addresses these questions testing the role of option-based plans – particularly vega controlling also for delta[5] – in the context of M&As. We use a sample of US acquisitions over the period from 1997 to 2011 and find strong support to our conjectures. As a preliminary step, we show that, consistent to the prior literature, acquisitions increase firm risk.[6] Post- or around the event (excess) stock return volatility of firms involved in acquisitions is significantly higher than their pre-announcement (excess) stock return volatility. Next, and most importantly, we find that CEO vega is positively associated to M&A investments at the 1% significance level. To gauge the economic significance of these estimates, an inter-quartile range increase in vega boosts M&A investments by approximately 4.22%. This is consistent with Edmans and Gabaix (2011) theoretical model of CEOs being offered greater risk-taking incentives to conduct risky investments.

We also perform the following empirical tests. We first explore what might drive the relation between risk-taking incentives and acquisition investments. Motivated by Ross (2004),

[4] Governance theory predicts that board monitoring and incentive compensation are likely to be substitute governance mechanisms. A recent study by Dicks (2012) presents a model in which governance and incentive compensation are substitutes in reducing agency costs.

[5] Guay (1999) suggests that the mix of vega and delta varies to a great extent across firms and both affect risk-taking behavior. Therefore, in order to draw fruitful conclusions with regards to the relation between vega and acquisition investments, we should also control for delta.

[6] Datta et al. (2001) provide evidence that acquirers with relatively higher equity-based compensation exhibit greater changes in stock return standard deviation post-acquisition; Bargeron et al. (2014) find that acquisition announcements are associated with an increase in bidder implied volatility; and finally, Furfine and Rosen (2011) and Hagendorff and Vallascas (2011) show that a merger increases acquirer default risk.

who argues that increasing the convexity of compensation through options does not necessarily make an agent more willing to take risks, and agents' attitudes towards risk are also important elements of their behavior, we perform a test to assess whether CEO overconfidence drives the relation between risk-taking incentives and M&A investments. Given the theoretical model of Gervais et al. (2011) that overconfidence can lead to increased risk-taking, increasing the convexity of the compensation contract could be irrelevant. In fact, it has been established in the literature that overconfident CEOs are significantly more acquisitive relative to non-overconfident CEOs (Doukas and Petmezas (2007), Malmendier and Tate (2008) and Billett and Qian (2008)). Indeed, when we partition the sample by overconfident and non-overconfident CEOs, we do find that the positive relation between risk-taking incentives and acquisition investments holds for the non-overconfident CEOs subgroup only.

In addition, we test the role of corporate governance in the relation between risk-taking incentives and M&A investments. We document that vega coefficient remains positive and significant, while its interactions with several corporate governance characteristics (such as entrenchment index, independent directors, dual class shares, CEO/Chairman duality and board size) appear generally not to capture the impact of CEO pay incentives on M&A investments.

Moreover, we pursue three different approaches to ease concerns regarding endogeneity. To deal with reverse causality, we use: i) the predicted estimates of lagged vega and delta; and ii) we perform systems of simultaneous equations. In particular, we run three-stage least squares (3SLS) regressions, in which the jointly determined variables are the acquisition investments, vega and delta. In both approaches our main result holds as CEO vega is positively associated with acquisition investments. To deal with potential unobserved confounding variables, we

employ the impact threshold for a confounding variable (ITCV) approach and find that our main results for vega are generally robust to omitted variables bias.

Additionally, we perform further robustness checks. First, we examine the impact of an increase in vega – instead of vega itself – on M&A investments. The intuition here is that CEOs with a significant increase in vega should be more prone to acquire other firms. This approach eases concerns that our results are due to firms with persistent high vega. Indeed, we find that an increase in vega is positively associated with acquisition investments.

Second, we analyze specific acquisition deals with arguably high risk. In particular, we examine bidders with increased return volatility after acquisitions, bidders that bid for large target firms, for private firms, and bidders that conduct diversifying acquisitions.[7] In all cases, vega is positively related to risky acquisition investments.

Third, we perform within firm analysis using logit regressions with firm fixed effects as in Yim (2013) and again our results show that M&A investments increase with vega. Finally, we examine the relation between CEO vega and the quality of an acquisition around the announcement. We find that CEO vega is positively associated with bidder 5-day announcement returns and this relation stands irrespective of the target public status.

This study has important contributions to the pay incentive-risk taking, M&As-executive compensation, as well as behavioral corporate finance, literature, respectively. First, it offers to the debate on the relation between vega and risk-taking providing empirical evidence of a positive association between risk-taking incentive compensation and M&As. Additionally, by incorporating both vega and delta in our empirical analysis, we are able to isolate the effect of each of these incentives on risk-taking. Second, this is the first study to our knowledge that

[7] As discussed in Section 7.2, there are conflicting arguments for diversifying acquisitions on whether they are relatively more or less risky deals.

attempts to shed light on what drives the association between risk-taking incentives and corporate investments, which has been ignored by prior literature; we show that CEO overconfidence lies behind the positive relation between CEO vega and acquisition investments. Third, it contributes to the behavioral corporate finance literature providing empirical support to the theoretical prediction of Gervais et al. (2011) that CEO overconfidence affects managerial compensation. Fourth, it provides new evidence that the association between risk-taking incentives and corporate investments is not affected by corporate governance mechanisms. Finally, it offers new insights to the existing literature on the association between CEO compensation and bidding firm shareholder value creation: we reveal that CEO risk-taking incentives increase bidder shareholders' wealth. This result implies that risk-taking incentives lead CEOs to select investment opportunities of relatively better quality.

Our study is related to the work of Tehranian et al. (1987), Datta et al. (2001), Grinstein and Hribar (2004), Coles et al. (2006), Harford and Li (2007), Edmans and Gabaix (2011), Gervais et al. (2011), Hayes et al. (2012) and Boulton et al. (2014). Whereas we examine the association between risk-taking incentives and M&As, considering also the effect of CEO overconfidence and the impact of corporate governance, Coles et al. (2006) and Hayes et al. (2012) explore the effect of CEO risk-taking incentives on investment in R&D, focus on a small number of businesses, leverage, and investment in property plant and equipment. Gervais et al. (2011) provide a theoretical model which shows that managerial overconfidence affects compensation packages. In the same spirit, we provide empirical evidence, in the M&A framework, that non-overconfident CEOs only are induced by risk-taking incentives to conduct acquisition investments. Harford and Li (2007) document compensation policy changes *after* acquisitions. They show that CEO's pay and overall wealth become insensitive to negative stock

performance, but CEO's wealth rises with positive stock performance. Our paper provides evidence of a relation between *pre-event* risk-taking incentives and acquisition investments. Grinstein and Hribar (2004) examine the relation between CEO pay and completion of M&A deals measuring compensation with cash bonus at the end of the acquisition year. We measure CEO pay with option-based contracts (i.e., risk-taking incentives) prior to the year of the acquisition. Additionally, Tehranian et al. (1987) and Datta et al. (2001) investigate within a sample of public acquisitions the effect of managers' long-term incentive plans and top five executives equity-based compensation contracts (i.e., delta), respectively, on acquiring firm announcement returns. We uncover the effect of CEO risk-taking incentives (i.e., vega) and find a similar association with bidder announcement returns. Boulton et al. (2014) examine the effect of equity based compensation (i.e., delta) on firm acquisitiveness providing evidence of a positive association. We show that vega is also positively related with firm propensity to make acquisitions. Overall, the findings of this study are consistent with the predictions of the theoretical model of Edmans and Gabaix (2011) when applied in the context of M&As.

The rest of the paper is organized as follows. Section 2 describes our sample and the variables used in the empirical analysis. Section 3 examines the effect of CEO risk-taking incentives on acquisition investments. Section 4 explores what drives the relation between risk-taking incentives and M&A investments. Section 5 assesses the role of several corporate governance mechanisms on the relation between vega and acquisition investments. Section 6 deals with endogeneity issues. Section 7 provides some further robustness checks. Section 8 examines the association between CEO vega and bidder announcement returns. Finally, section 9 concludes the paper.

2. Data

2.1 Sample Construction and Summary Statistics

Our sample consists of all NYSE, AMEX, and NASDAQ firms jointly listed on the COMPUSTAT ExecuComp Database, the COMPUSTAT annual industrial files, and the CRSP files from 1996 through 2010. Our sample is composed of 3,144 firms for a total of 28,853 firm/year observations.[8] Acquisition data are obtained from Thomson Financial SDC Mergers and Acquisitions Database and include all acquisitions by US publicly listed bidding firms over the period 1997 to 2011 with a deal value above US$1 million. To be included in the acquisition sample, the bidder must own less than 10% of the target's equity before the deal and must seek to purchase more than 90% of the target's equity. After matching the two samples, we find that 2,056 bidders (6,587 firm-year observations) conducted 9,789 acquisitions over the period 1997 to 2011, out of which 9,003 are completed.[9]

Coles et al. (2006) review prior empirical evidence on executive compensation measures and argue that they were, at the very best, noisy proxies for delta and vega. Hence, as the authors highlight, the estimation of vega and delta for the manager's entire portfolio leads to a more precise CEO measure of incentives than relying on potentially noisy proxies such as the number or value of options or stock held or granted. Therefore, we estimate *vega*, which is the change in the dollar value of the CEO wealth for a 1% change in the annualized standard deviation of stock returns, and *delta*, which is the dollar change in CEO wealth for a 1% change in stock price. The

[8] Excluding firms from financial industries (SIC codes 6000-6999) does not alter our main results. Specifically, 546 sample firms are from financial industries (4,390 firm/year observations). These firms carried out 1,556 acquisitions during our sample period.

[9] The remaining acquisitions are pending (460), intended (8), partially completed (4), and withdrawn (314). Our main results hold when we limit the sample to completed deals.

vega and *delta* calculations follow Guay (1999) and Core and Guay (2002).[10] Guay (1999) shows that option vega is many times higher than stock vega. Consequently, to conform with prior literature (Knopf et al. (2002), Rajgopal and Shevlin (2002) and Coles et al. (2006), among others), we use the vega of the option portfolio to measure the total vega of the stock and option portfolios.

Table 1, Panel A reports descriptive statistics for CEO pay, breaking down total compensation into cash compensation (salary plus bonus), equity compensation, CEO wealth and CEO incentive measures. CEO compensation figures are obtained from ExecuComp database. We winsorize all our non-binary variables at the 1st and 99th percentile. All dollar values are stated in 2005 dollars.

Equity based compensation is on average more than 73% of the total compensation (US$ 3.427 million/US$ 4.693 million), and option compensation represents a large fraction of equity based compensation (US$ 2.311 million). Delta and vega are not based merely on the annual compensation, but they depend on the wealth that a CEO has accumulated over time in the forms of stock and stock option grants. The value of the CEO wealth, given by the sum of the stock and option portfolios, is on average above US$ 66 million, with most of the value sourcing from the stock portfolio (about US$ 53 million). The mean (median) *vega* is US$ 130,000 (US$ 47,000), and the mean (median) *delta* is approximately US$ 842,000 (US$ 234,000). These values are larger than those reported by Coles et al. (2006), a finding that is plausible considering that our executive compensation sample period terminates in 2010 and equity compensation increased sharply between 2005 and 2010.

[Please Insert Table 1 About Here]

[10] See Edmans et al. (2009) for a detailed description of the computation of *delta* and *vega*. We assume that the maturity of all options is 70% of the stated maturity. Results do not change if we relax this assumption.

2.2 Variables and Summary Statistics

In our empirical analysis, we control for the following variables that have been found in the prior literature to be correlated with the propensity of an acquisition investment. All variables are defined in Appendix A. We use the log of sales as a proxy of *size* conforming to the common practice of the CEO literature (see, e.g., Hall and Murphy (2002), Conyon et al. (2011) and Fernandes et al. (2013)). Sales represent firm's total sales in year *t*. Harford (1999) and Faccio and Masulis (2005) find that large firms carry out more acquisitions.

Book-to-Market *(b/m)* is firm book value of equity divided by market value of equity at the end of year *t* from COMPUSTAT. According to the market-driven theory of acquisitions (Shleifer and Vishny (2003)), firms make more acquisitions when their stock is overvalued.

Cash reserves variable is defined as firm cash and short-term investments divided by the book value of total assets at the end of the fiscal year. Cash-rich firms are relatively more likely to engage in acquisitions (Jensen (1986)), as also empirically documented by Harford (1999) and Faccio and Masulis (2005).

Leverage represents firm total financial debt (long-term debt plus debt in current liabilities) divided by the book value of total assets at the end of the fiscal year. Leverage has competing effects on the propensity to acquire. On the one hand, leverage can increase the likelihood of becoming a bidder by inducing firms to take on risky investments; on the other hand, an excessive debt level may reduce the ability to acquire by exhausting new debt issuing capacity. While Harford (1999) finds no evidence that leverage affects the probability to buy other firms, Faccio and Masulis (2005) document a positive relation between leverage and the propensity of an acquisition. Uysal (2011) observes that overleveraged firms are less likely to carry out acquisitions.

Cash flows variable, as used in Titman et al. (2004), is defined as (operating income before depreciation minus interest expenses minus taxes minus preferred dividends minus common dividends) scaled by book value of total assets in the fiscal year, and it is our proxy for firm's internally generated funds.[11] Firms generating high levels of internal cash-flows are less constrained in their investment policies, thus increasing the likelihood of an acquisition (Bauguess and Stegemoller (2008)).

We also control for CEO overconfidence by constructing an overconfidence variable which is based on the Holder 67 measure of Malmendier and Tate (2005, 2008). In the spirit of Hirshleifer et al. (2012), *overconfidence* is a binary variable that takes the value of one when a CEO fails to exercise options with five years remaining duration despite a stock price increase of at least 67% since the grant date, and zero otherwise. Differently from Malmendier and Tate (2005, 2008), where once a CEO is identified as overconfident, she remains so for the rest of the sample period, we measure overconfidence on a yearly basis.[12] As noted by Malmendier et al. (2011) and Hirshleifer et al. (2012), ExecuComp does not provide detailed data on the CEO's options holdings and exercise prices for each option grant for our entire sample period. To overcome this problem, we follow Campbell et al. (2011) and Hirshleifer et al. (2012) in calculating an average moneyness of the CEO's option portfolio for each year. First, for each CEO-year, we divide the total realizable value of the options by the number of options held by the CEO to determine the average realizable value per option. The strike price is calculated as the fiscal year-end stock price minus the average realizable value. The average moneyness of the options is then calculated as the stock price divided by the estimated strike price minus one. Only

[11] Cash flows variable is highly correlated with ROA (0.85). Thus, we do not include the profitability variable, which is defined as firm EBITDA divided by its book value of total assets at the fiscal year-end from COMPUSTAT, in our regression models.

[12] Treating overconfidence as a managerial fixed-effect following Malmendier and Tate (2005, 2008) does not alter our results.

the vested options held by the CEO are included in the computation. Malmendier and Tate (2008) argue that overconfident managers are more acquisitive.

Further, we include in our analysis other CEO-specific variables, which are obtained from the ExecuComp database and proxy for managerial risk aversion and entrenchment. Specifically, we include *cash compensation*, CEO gender (*female*), *age*, and tenure (*CEO tenure*). *Cash compensation*, *female*, and *age* proxy for risk aversion of the manager. The direction of the effect of cash compensation is far from straightforward. On the one hand, Guay (1999) posits that CEOs with higher total cash compensation are better diversified, as they have more money to invest outside the firm, and, therefore, are less risk averse. On the other hand, Berger et al. (1997) argue that CEOs with higher cash compensation are more likely to be entrenched and will seek to avoid risk. With regards to the gender, Barber and Odean (2001) suggest that male investors are more risk-prone and overconfident than female investors. In the same spirit, Huang and Kisgen (2013) provide evidence that male CEOs make more acquisitions than female CEOs.[13] Finally, we control for *CEO age*. Yim (2013) shows a negative association between CEO age and acquisitiveness. Additionally, *CEO tenure* is a proxy for managerial entrenchment. Longer-tenured CEOs have usually more power than newly-appointed CEOs, and they can exert this power embarking in acquisition programs.

Further, we include two additional control variables which have been shown in the literature to affect acquisition propensity. Harford (1999) shows a positive association between firm prior abnormal return and probability to make an acquisition. Our variable for excess stock price performance is *abnormal return*, which is computed as the buy-and-hold excess stock return over the calendar year, i.e., $\Pi(1 + R_{i,m}) - \Pi(1 + R_{p,m})$, where $R_{i,m}$ and $R_{p,m}$ are the return for firm *i* and the return of the benchmark portfolio for month *m*, respectively (Denis and Sibilkov

[13] Levi et al. (2014) also show that firms with female directors are less likely to make acquisitions.

(2010)). Benchmark portfolios are the twenty-five Fama-French value-weighted portfolios based on size and book-to-market. We also add the *M&A liquidity* index as in Schlingemann et al. (2002) and Uysal (2011). This is defined as the sum of acquisitions value for each year and Fama-French 49 industry classification divided by the total assets of all COMPUSTAT firms in the same Fama-French 49 industry classification and year.[14] Uysal (2011) provides evidence of a positive relation between the M&A liquidity index and acquisition probability.

The final set of variables takes into account several corporate governance characteristics at firm level. Bauguess and Stegemoller (2008) suggest that corporate governance characteristics affect the decision to acquire, providing evidence consistent with benefits to managerial initiative when managers are insulated from discipline, i.e., more value-increasing acquisitions. Data for the corporate governance variables are from RiskMetrics. Our set of corporate governance variables is composed of five variables: *entrenchment index*, *DCS*, *independent directors*, *CEO/Chairman* and *board size*. *Entrenchment index* is an index proposed by Bebchuk et al. (2009) and is defined as the sum of binary variables concerning the following provisions: 1) classified boards; 2) limitations to shareholders' ability to amend the bylaws; 3) supermajority voting for business combinations; 4) supermajority requirements for charter amendments; 5) poison pills; and 6) golden parachutes. *DCS* is a binary variable that takes the value of one if the firm is a dual-class shares company, and zero otherwise. The dual class structure allows controlling shareholders to separate control from ownership, effectively controlling the firm with a lower percentage of cash flows rights. Masulis et al. (2009) find that executives related to the controlling shareholder in DCS firms receive higher total compensation than those in firms with single class shares, a result consistent with the managerial power theory (Bebchuk and Fried

[14] We have also used the 3-digit SIC code (instead of the Fama-French 49 industry classification) and our results are not altered.

(2003)). We measure the independence of the board of directors with *independent directors*, which is the ratio between the number of independent directors and the board size. A CEO is more powerful and entrenched when he/she is also Chairman of the board of directors. *CEO/Chairman* is a binary variable that takes the value of one if the roles of CEO and Chairman of the Board are not split, and zero otherwise. *Board size* is the number of directors of the board. Bauguess and Stegemoller (2008) report that acquisitions are more likely to occur when firms have large boards.

Panel B reports summary statistics on firm and CEO characteristics. Concerning CEO characteristics, the average tenure is more than 6.5 years, with a median of 5 years. Thus, the average CEO has been with the company for a relatively long time, and therefore his *delta* and *vega* (our executive compensation measures) are functions of the wealth accumulated over this long period. Very few companies are run by female CEOs (only 2%), and less than half of the CEOs are overconfident (47%). The mean (median) CEO age is 55 years, consistent with Yim (2013). The percentage of independent directors is well-above 50% (i.e., 68.7%), which is in line with Duchin et al. (2010). Confirming previous literature (for instance, Ferris et al. (2003) and Duchin et al. (2010)), the average board is composed of about 9.5 directors. The CEO retains also the title of Chairman of the board in 55.27% of the observations. Firms with a dual-class share structure are about 9%, which is higher than the 6% found by Masulis et al. (2009) for the entire universe of COMPUSTAT listed firms. Finally, the firm mean excess return is 4.01%.

Panel C presents summary statistics on the acquisitions sample. The mean value of acquisition deals is approximately US$ 118 million, while, on average, 22% of our sample firms attempted an acquisition bid in a given year. Diversifying acquisitions represent the 34% of the sample and almost 92% of the bids are completed. Private deals account for the lion share of the

overall takeover activity (78.45%), with public acquisitions representing the 21.55% of the total deals. Finally, with regards to the method of payment, the mean proportion of cash (stock) used in the acquisition bids of our sample is 46% (19%).

3. Empirical Analysis

3.1 Acquisitions and Change in Firm Risk

Our premise that risk-taking incentives induce CEOs to conduct an M&A investment is based on the notion that acquisitions are risk-increasing corporate investments. Whereas prior studies have already provided evidence in support of firm risk increase after acquisitions, we still investigate the issue in our sample, before analyzing the relation between risk-taking incentives and acquisition investments. We therefore examine the change in bidder risk in three ways: i) we measure the difference between the bidder standard deviation of daily (excess) stock returns over the period (+60, +120) days after the acquisition announcement and the one over the period (-120, -60) days prior to the announcement; ii) we measure the difference between the bidder standard deviation of daily (excess) stock returns over the event window (-30, +30) days surrounding the acquisition announcement and the one over the period (-120, -60) days prior to the event; and iii) we measure the difference between the bidder standard deviation of daily (excess) stock returns over the period (+1, +60) days after the acquisition effective date and the one over the period (-120, -60) days prior to the acquisition announcement.

Table 2 reports the results. The difference between bidder post-announcement, post-effective date, as well as around the acquisition announcement stock return volatility, and bidder pre-announcement stock return volatility is positive and strongly statistically significant in both mean and median terms for both stock return volatility and excess stock return volatility. Overall,

the results signify that acquisitions increase firm risk and are therefore, on average, risky investments. To make things worse, CEOs are also exposed to risk when deciding an acquisition, which firm return volatility does not take into account, implying that all acquisitions involve some sort of risk, for which CEOs should receive incentives.

[Please Insert Table 2 About Here]

3.2 Risk-Taking Incentives and Acquisition Investments

After having documented that acquisitions are risky investments, we examine the relation between risk-taking incentives and acquisition investments by controlling for various characteristics, which have been found in the prior literature to affect acquisition investments. Table 3 reports the results for this analysis. In specification (1) we run pooled tobit regressions where the dependent variable is the sum of the deal values of acquisitions made in a given year scaled by firms' size in the previous year.[15] To mitigate endogeneity concerns, all independent variables, including *vega* and *delta*, are lagged. All regressions also control for year and industry fixed effects whose coefficients are suppressed. Moreover, we use heteroskedasticity-robust standard errors adjusted also for clustering at firm level.

Our main variable of interest is the sensitivity of CEO wealth to stock return volatility (i.e. *vega*). Specification (1) also includes *delta* and several control variables, such as *size, b/m, cash reserves, leverage, cash flows, overconfidence, cash compensation, female, CEO tenure, CEO age*, *abnormal return* and *M&A liquidity*.[16] We find that the coefficient on *vega* is positive and statistically significant at the 1% significance level. From the control variables, *delta, cash flows,*

[15] The advantage of tobit analysis compared to probit is that it overcomes the problem of several acquisitions being small relative to bidder size in our sample.

[16] The correlation matrix of the variables is presented in Appendix B. Our main variable of interest – *vega* – does not exhibit high correlation with the control variables. This should moderate econometric difficulties (such as multicollinearity concerns) in disentangling any effects of the compensation variable on M&A investments.

overconfidence, *cash compensation* and *abnormal return* exhibit a positive relation with acquisition investments at the 1% significance level, while *b/m* and *CEO age* have a negative association with acquisition investments both at the 1% significance level, in line with the existing M&A literature.

In specification (2), instead of using a tobit model, we run a pooled probit regression where the dependent variable takes the value of one if the firm made at least one acquisition in a given year, and zero otherwise. Our results are robust to the methodology employed as *vega* carries a positive and significant coefficient at the 5% level. These findings imply that risk-taking incentives increase the probability a CEO to carry out an acquisition deal.[17] The signs on the control variables exhibit, in general, the same relation as in specification (1), with size becoming statistically significant in specification (2) and carrying a positive sign consistent to the prior literature.

In economic terms, an inter-quartile range increase in *vega* from the 25th to the 75th percentile boosts acquisition investments by approximately 4.22% in specification (1) and 3.02% in specification (2).[18] Overall, our results support Edmans and Gabaix (2011) theoretical model which predicts higher risk-taking incentives for risky investments.

[Please Insert Table 3 About Here]

[17] We have also run tobit and probit analyses for the probability that *vega* leads to completed acquisition deals. We still find a positive relation, which is interpreted as shareholders want to incentivize executives for creating value in deals, which may or may not coincide with announced acquisitions.

[18] This percentage change in acquisition investments is calculated as the difference between the fitted value of acquisition investments, with *vega* measured at its 75th percentile, and the fitted value of acquisition investments with *vega* measured at its 25th percentile, divided by the latter value. To compute the fitted values, all other control variables are fixed at their mean values.

4. What Drives the Relation Between Risk-Taking Incentives and Acquisition Investments?

An interesting question that arises from the positive relation between risk-taking incentives and acquisition investments is whether specific CEOs attributes play a role. Ross (2004) argues that increasing the convexity of compensation through options – which is an incentive alignment mechanism based on the assumption that managers are rational and risk-averse – does not necessarily make agents more willing to take risks; as the author suggests, agents' attitudes towards risk are also important. Along these lines, the theoretical model of Gervais et al. (2011) shows that overconfidence can lead to increased risk-taking, making the convexity of the compensation contract relatively less relevant. In particular, overconfident managers underestimate the residual risk of the project and are thus more likely to invest in it. In fact, CEO overconfidence could be an alternative solution to the traditional problem of managerial risk aversion. It could align managers' decisions with the interests of shareholders and reduce the need for option-based compensation while still motivating an optimal level of managerial risk taking (Gervais et al. (2011)). In this case, compensating overconfident CEOs with risk-taking incentives would be redundant and represent a cost to shareholders. Therefore, we predict that, on average, risk-taking incentives should increase acquisition investments but this relation should be driven by non-overconfident CEOs, who are the ones that are more sensitive to risk-taking incentives.

Table 4 presents the results. Specification (1) includes all acquisitions. We use the same set of control variables as in previous analysis and we also add the *interaction of vega (and delta) with overconfidence*. We find that *vega* carries a positive and strongly significant coefficient at the 1% level, whereas the *interaction of vega with overconfidence* is negative and statistically

significant at the 1% level. This result indicates that offering risk-taking incentives to overconfident CEOs does not increase acquisition investments. In other words, overconfident CEOs do not essentially need risk-taking incentives to conduct acquisitions. In specifications (2) and (3), we split the sample into overconfident and non-overconfident CEOs subgroups, respectively. We document that *vega* increases acquisition investments only in the non-overconfident CEOs subgroup with a coefficient significant at the 1% level, which suggests that only non-overconfident CEOs are sensitive to risk-taking incentives. This result is in line with the literature, which has established that overconfident CEOs are significantly more acquisitive relative to non-overconfident CEOs (Doukas and Petmezas (2007), Malmendier and Tate (2008) and Billett and Qian (2008)). Therefore, CEO overconfidence seems to alleviate managerial risk aversion in conducting acquisition investments, which makes option-based contracts less useful. This finding further implies that increasing the convexity of the compensation contract would be less relevant for overconfident managers, since they do not need particular incentives to initiate risky investments. In contrast, this is not the case for non-overconfident CEOs, who need risk-taking incentives to conduct investments. Therefore, the convexity of option-based contracts is essential in order to induce non-overconfident managers to take risk. Economically, an inter-quartile range increase in *vega* from the 25^{th} to the 75^{th} percentile translates into an approximately 7.62% increase in acquisition investments of non-overconfident CEOs. Overall, these results indicate that CEO overconfidence plays a role in the relation between risk-taking incentives and corporate investments, in support of the theoretical model of Gervais et al. (2011).

[Please Insert Table 4 About Here]

5. The Role of Corporate Governance

Given the recent theoretical model by Dicks (2012), in which governance and incentive compensation are substitutes in reducing agency costs, in this section, we assess whether corporate governance mechanisms capture the effect of risk-taking incentives on acquisition investments. Table 5 presents the results for this tobit analysis. In total, we include five corporate governance variables in our regressions; namely *entrenchment index, independent directors, DCS, board size* and *CEO/Chairman*. The main variable of interest is again *vega*. We also interact *vega* (and *delta*) with all five governance variables and incorporate all other control variables used in Table 3.

We find that *vega* coefficient is always positive and statistically significant at conventional levels. This indicates that risk-taking incentives motivate CEOs to carry out M&A investments. In contrast, the interaction variables of vega with corporate governance characteristics are never statistically significant at conventional levels (apart from the interaction variables of *vega* with *DCS* and *CEO/Chairman* that are both marginally significant at the 10% level and carry a negative sign). The signs on other explanatory variables are similar to previous analysis. In sum, the findings of this section reflect that corporate governance does not generally affect the relation between risk-taking incentives and acquisition investments.

[Please Insert Table 5 About Here]

6. Endogeneity Issues

6.1 Predicted Values of Vega and Delta

In this sub-section, we further examine whether vega induces managers to implement acquisition investments by reporting estimates from regressions of acquisition investments on

lagged vega, lagged delta and control variables (same as in the main analysis). In particular, we use either the lagged values of vega and delta or the vega and delta predicted from the regressions as instruments for vega and delta. We include our endogenous variable (i.e., acquisition investments) on the right hand side. We calculate the predicted values of lagged vega and lagged delta for a firm in a given year by using the estimated regression coefficients. Residual lagged vega (or lagged delta) is the actual minus the predicted value.

Table 6 reports the results. In specification (1) we find that *predicted vega* is positive and significant at the 1% level. In specification (2) we use the predicted and residual incentives from regressions of vega and delta on endogenous and control variables. Again, the *predicted vega* carries a positive and statistically significant coefficient at the 1% level supporting our previous findings. Finally, we find that the *predicted vega (delta)* coefficient does not have the same sign with the *residual vega (delta)* coefficient, which implies that the components of vega and delta that are orthogonal to the other right-hand side variables do not have explanatory power. Additionally, given that the *predicted vega* is included on the right hand side, the negative coefficient on *residual vega* is a first indication that there is no causation flowing the other direction (Coles et al. (2006)).

[Please Insert Table 6 About Here]

6.2 Systems of Simultaneous Equations (3SLS): Acquisition Investments, Vega and Delta

So far our analysis has been based on the notion that risk-taking incentives and acquisition investments are not jointly determined. To alleviate concerns that our results are driven by causality we apply a simultaneous equations approach as in Coles et al. (2006).

Table 7 shows the results for the systems of simultaneous equations analysis. More specifically, we run three-stage least squares (3SLS) regressions, in which the jointly determined variables are acquisition investments, vega and delta. We have the same independent variables as in previous analysis for the acquisition investments model and we follow Coles et al. (2006) for the vega and delta models. Following the common approach in systems of simultaneous equations, we use contemporaneous rather than lagged values of independent variables. The regressors for vega are *acquisition investments*, *delta*, *size*, *b/m*, *leverage*, *cash flows*, *cash compensation*, *CAPEX*, *annualized excess return volatility* and *EBITDA/interest expenses*. The regressors for delta are *acquisition investments*, *vega*, *size*, *b/m*, *leverage*, *CEO tenure*, *CAPEX* and *annualized excess return volatility*.

Importantly, *vega* is positive and strongly significant at the 1% significance level. This indicates a strong positive association between *vega* and acquisition investments. With regards to the control variables, they are generally consistent to the analysis in previous sections and with the prior literature. Similarly, the determinants of *delta* and *vega* are generally in line with previous research. In a nutshell, our results are robust controlling for potential reverse causality reflecting that risk-taking incentives motivate CEOs to undertake acquisition investments.

[Please Insert Table 7 About Here]

6.3 The Impact of Unobserved Confounding Variables

In our last attempt to deal with potential endogeneity bias, we assess the impact of unobserved confounding variables. Given that the omitted variable bias is the product of its correlation with the independent variable of interest (i.e., vega) and the dependent variable (i.e., acquisition investments), the stronger the two correlations, the more biased the coefficient

estimate, where the product of the two correlations indicates the degree of the bias. Therefore, we follow Larcker and Rusticus (2010), Fu et al. (2012) and Karampatsas et al. (2014) and examine the severity of the endogeneity problem to overturn our main results by deriving the minimum correlations necessary to turn a statistically significant into an insignificant result. This is achieved by estimating the impact threshold for a confounding variable (ITCV) proposed by Frank (2000). The larger (smaller) the ITCV, the more (less) robust the main results are to omitted variables concerns.

The ITCV for *vega* is presented in Table 8. The threshold value for *vega* is 0.0145 implying that the correlations between *vega* and *acquisition investments* with the unobserved confounding variable each only need to be 0.120 ($=\sqrt{0.0145}$) for the main results to be overturned. Nevertheless, it is difficult to determine whether the ITCV is large enough to conclude about the association between vega and acquisition investments and whether our main results are not affected by an unobserved confounding variable. Therefore, to further assess the issue, it is necessary to use our control variables to compute a benchmark for the magnitude of possible correlations involving the unobserved confounding variable. Hence, we estimate the impact for each of our control variables, that is defined as the product of the partial correlation between the *x*-variable and the control variable and the correlation between the *y*-variable and the control variable (partialling out the effect of the other control variables). In column (2) we present the impact of the inclusion of each independent variable on the coefficient of *vega*. The ITCV is larger than all control variables but delta and size (having a value of 0.0160 and -0.0269, respectively) out of the thirteen control variables, which means that we would need a confounding variable with a stronger impact than the latter variable to overturn our results. Additionally, in our empirical analysis we employ a comprehensive set of control variables

recognized from the literature to affect the propensity of acquisition investments. Putting both together, these results reinforce the validity of the estimate for the effect of *vega* on the probability of acquisition investments.

In column (3) we also calculate the $Impact_{raw}$ for each of the control variables, which is based on the raw correlations instead of the partial correlations and is a more conservative measure of the impact of unobserved confounding variables. In column (3) again only two control variables (delta and size) out of the thirteen control variables have higher impact than the relevant ITCV, which reinforces that under the assumption that we have a good set of control variables, it is unlikely that such an unobserved confounding variable exists. Overall, our analysis for the impact of unobserved confounding variables suggests that our main results for *vega* are generally robust to omitted variables bias.

[Please Insert Table 8 About Here]

7. Further Robustness Checks

7.1 Increase in Risk-Taking Incentives and Acquisition Investments

To further confirm that risk-taking incentives increase acquisition investments, we use the *vega increase* instead of *vega* itself as main variable of interest. One could argue that our results are due to firms with persistent high vega. This approach allows us to test whether a discrete and significant increase in vega induces more acquisition investments. The *vega increase* is a binary variable that takes the value of one if the difference between vega in year *t* and vega in year *t-1*, scaled by vega in year *t-1*, is larger than 10% and zero otherwise.[19] Accordingly, we define the *delta increase*. Table 9 presents the results. We report a strong positive association at the 1%

[19] Similar results are obtained when we increase the cut-off point to 20%.

(10%) significance level between the *vega increase* (and *delta increase*) and acquisitions, which adds further evidence to our prior findings that an increase in risk-taking incentives induces CEOs to conduct acquisition investments.

[Please Insert Table 9 About Here]

7.2 Risk-Taking Incentives and Risky Acquisition Investments

For robustness reasons, we further analyze the proposition that risk-taking incentives induce CEOs to undertake risky acquisition investments. This is particularly the case in acquisitions: i) in which bidders' total risk increased after the deal relative to the risk prior to the acquisition (i.e., increased bidder return volatility);[20] ii) of large target firms; iii) of private target firms; and iv) of targets operating in different industries relative to the ones of the bidder (i.e., diversifying deals). Diversification is defined at the 4-digit SIC level.[21] Regarding target size, Alexandridis et al. (2013) argue that large deals are associated with potential integration complexity, which leads to more uncertain expected synergies from the combination. Concerning private target firms, Officer (2007) suggests that information asymmetry is particularly pronounced in private acquisitions, which make them riskier than acquisitions of public firms. For diversifying acquisitions the direction regarding riskiness is ambiguous. On the one hand, corporate diversification may reduce firm risk because assets in place could be less risky than growth options (Gomes et al. (2003) and Carlson et al. (2006)). Additionally, managers have an incentive to reduce firm risk, and corporate diversification can be a strategy to achieve this goal

[20] These are bidding firms, whose return volatility increased over the period 1 day to 60 days following the acquisition effective date relative to 120 days to 60 days prior to the acquisition announcement date. Our results are qualitatively similar when using the period 60 days to 120 days following the acquisition announcement date relative to 120 days to 60 days prior to the acquisition announcement date.

[21] Our results are similar when the target firm operates in a different industry to the one of the bidder at the 3-digit SIC level.

(Amihud and Lev (1981) and Acharya et al. (2011)). On the other hand, Zhang (2005) demonstrates that assets in place are riskier than growth options, especially in crisis periods, because they are harder to reduce. Hence, by converting some of these growth options via corporate diversification, managers might actually increase firm risk. Further, it is plausible to argue that acquisitions of firms operating in different industries are riskier for managers because they are more likely to be outside their area of expertise, and managers may have relatively less knowledge and information about the target firm industry.

Table 10 reports the results. Specification (1) deals with increased bidder return volatility acquisition investments, specification (2) shows the estimates for large acquisitions, specification (3) presents the estimates for private acquisition investments, and specification (4) shows the results for diversifying acquisitions. We find that in all cases *vega* is positively associated with risky acquisition investments at conventional significance levels.[22] All other control variables have generally the same relation with acquisition investments as in Table 3. Overall, these findings imply that risk-taking incentives induce CEOs to undertake risky investments.

[Please Insert Table 10 About Here]

7.3 Within Firm Results

As a last robustness check, we examine within firm results with firm fixed effects as in Yim (2013). This allows to further eliminate any concerns that there might be some unobserved characteristics which lead to biased estimates in our regressions. Table 11 presents the results.

[22] The finding for diversifying acquisitions is in contrast with Gormley et al. (2013), who use a natural experiment of an increase in liability and regulatory risk from workers' exposure to newly identified carcinogens of 143 US firms over the period 1984-2008, and find that CEOs with lower risk-taking incentives conduct more diversifying acquisitions (and reduce firm leverage, R&D and stockpile cash).

Vega is again positive and statistically significant at 10% level, supporting our argument that risk-taking incentives induce CEOs to invest in acquisitions.

[Please Insert Table 11 About Here]

8. Risk-Taking Incentives and Acquisition Quality

In this section, we address the question of whether CEO risk-taking pay incentives lead to larger bidding firm announcement returns. Prior studies provide evidence that, in general, top executive incentive plans (i.e., delta) have a positive relation with acquiring firm announcement stock returns (see, e.g., Tehranian et al. (1987) and Datta et al. (2001)). Our main dependent variable is the bidder 5-day CARs surrounding the acquisition announcement. The returns are calculated using the market model with the market model parameters estimated over the period starting 240 days and ending 41 days prior to the announcement. CRSP value-weighted index return is the market return.[23] Our main variable of interest is again *vega* controlling also for *delta*. We use the same set of explanatory variables used in previous analysis including also the variables *ln (MV), relative size, diversifying, completed, hostile, public, annualized return volatility, stock, bidder CAR (-30, -3)* and *M&A liquidity*, which have been found by prior studies to affect bidder announcement returns.

Table 12 reports the results for acquisition quality. In specification (1) *vega* is positive and statistically significant at the 5% level. This finding indicates that CEO risk-taking incentive pay plans are related with an increase in bidding firm shareholders' wealth. The signs on the control variables are, generally, consistent to the prior M&A literature. For instance, *size*, *cash reserves*,

[23] We also use alternative short-run announcement period return windows such as (-1, +1) and (-5, +5); we use equally-weighted CRSP index (as opposed to value-weighted) as the market return; iii) we use market-adjusted abnormal returns (i.e., assuming $\alpha=0$ and $\beta=1$ as market model parameters); iv) we winsorize the returns at the 1st and 99th, or 5th and 95th percentiles to control for outliers. None of these variations change our results.

public, *stock* and *M&A liquidity* hold a negative and statistically significant coefficient at conventional levels, whereas *completed* is positively associated with bidder announcement returns. In specification (2) we perform the same analysis using also *the interaction of vega (and delta) with public* to examine whether target status affects the relation between *vega* (*and delta*) and bidder announcement returns. We find that *vega* itself is still positive and statistically significant at the 5% significance level, whereas the *interaction of vega with public* is insignificant at conventional levels. Finally, in specification (3) we interact *vega* with *overconfidence* (and *delta* with *overconfidence*). While *vega* itself remains positive and significant at the 5% significance level, the interaction variables are not significant at conventional levels, which suggests that overconfidence does not affect the association between vega (and delta) and bidder announcement returns. Additionally, in our tests we do not find evidence that deals carried out by overconfident CEOs are worse off. In sum, this positive relation between risk-taking incentives and bidder stock returns allows us to conclude that CEOs with higher risk-taking incentives select investment opportunities of relatively better quality in line with the theoretical predictions of Edmans and Gabaix (2011).

[Please Insert Table 12 About Here]

9. Conclusions

Consistent with the theoretical model which predicts that risk-averse CEOs with greater risk-taking pay incentives are induced to undertake risky projects, we find that risk-taking incentives, measured with vega, are positively related with M&A investments. In economic terms, an inter-quartile range increase in vega translates into an approximately 4.22% enhancement in acquisition investments.

In addition, we provide evidence that the positive relation between vega and acquisitions is confined only to non-overconfident CEOs subgroup. Addressing the problem of causality does not change our main conclusion of the positive association between CEO vega and acquisition investments. Additionally, we provide evidence that our results are generally robust to omitted variables concerns. Finally, we find a positive association between CEO risk-taking incentives and bidder announcement returns, irrespective of the target public status.

Our findings have also important implications. In particular, higher option-based CEO pay might have led to the increase in the M&A activity before the recent financial crisis that peaked in 2008. Additionally, our results imply that corporate boards should structure compensation packages based not only on the riskiness of the project but also on the behavioral characteristics of the CEO. After all, as Goel and Thakor (2008, page 2739) argue, "CEO overconfidence is an empirically detectable attribute". In addition, the findings on confidence level pave the way for future research in determining potential other factors that might drive the relation between risk-taking incentives and corporate investments. Finally, the positive relation between CEO risk-taking incentives and bidder stock returns provides evidence in support of the view that risk-taking incentives motivate managers to select investment opportunities of relatively better quality.

Nevertheless, a question that arises from the bidder announcement return results is what prevents firms to always offer a high vega for acquisitions? Potential explanations for firms not offering high levels of risk-taking incentives to CEOs are related, for example, to the association between vega and systematic risk (Armstrong and Vashishtha (2012)), to misreporting (Larcker et al. (2013)), and to the reputational costs for the firm's directors (Ertimur et al. (2012)). First, Armstrong and Vashishtha (2012) show that vega is associated with an increase in systematic

risk because CEOs can hedge this risk by buying the market portfolio. As the authors argue (page 87): "this could lead to excessive systematic risk in equity markets, which may, in turn, lead to reduced risk-sharing among investors and lower firm values". Second, Larcker et al. (2013) document a positive association between vega and misreporting, which might reduce the benefits from a high vega for some firms. Finally, Ertimur et al. (2012) posit that outside directors, especially those who are compensation committee members, may not be inclined to increase executives' risk-taking incentives because there could be reputational penalties if they later fail to monitor effectively. Despite these explanations, we hope future research will shed light on why high vega levels are not optimal for all firms even if they lead to better acquisitions.

In response to the questions raised in the introduction, the findings of this paper indicate that CEO pay incentives-risk taking mechanism does function in firm investment decisions inducing CEOs to undertake acquisitions, in return for higher compensation. Additionally, non-overconfident CEOs drive the positive relation between risk-taking incentives and corporate acquisitions. Further, corporate governance mechanisms do not generally seem to affect the relation between risk-taking incentives and acquisition investments. Finally, the link of managerial wealth with firm performance improves CEOs risk-taking investment choices at the benefit of their shareholders. Overall, this paper provides new empirical evidence on the debate about risk taking and investment policy association in the M&As setting.

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Appendix A

Variable Definitions

Variable	Definition
	Panel A: Compensation Variables
Total Compensation	(ExecuComp data item TDC1). It includes salary, bonus, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), and long term incentive payouts in the fiscal year *t-1*.
Cash Compensation	(ExecuComp data item TCC). It includes salary and bonus in the fiscal year *t-1*.
Equity Compensation	The difference between TDC1 and TCC.
Option Compensation	(ExecuComp data item OPTION_AWARDS_BLK_VALUE). The aggregate value of stock options granted to the executive during the year as valued using Standard & Poor's Black-Scholes methodology.
CEO Wealth ($ 1,000)	The sum of Stock Portfolio and Option Portfolio.
Stock Portfolio ($ 1,000)	The value of firm's shares at the end of the fiscal year. It is the product of ExecuComp data item SHROWN_EXCL_OPTS (Shares Owned - Options Excluded) and COMPUSTAT data item PRCC_F (the stock price) at the end of the fiscal year.
Option Portfolio ($ 1,000)	The value of the options held by the CEO at the end of the fiscal year. It is defined as the sum of the estimated value of in-the-money Unexercised Unexercisable Options (OPT_UNEX_UNEXER_EST_VAL) plus the estimated value of in-the-money Unexercised Exercisable Options (OPT_UNEX_EXER_EST_VAL).
Vega	Vega is the change in the dollar value of the CEO wealth for a one percentage change in the annualized standard deviation of stock returns at the end of the fiscal year.
Delta	The change in the dollar value of the CEO wealth for a one percentage point change in stock price at the end of the fiscal year.
Vega Increase	Binary variable that takes the value of 1 if the difference between vega in year *t* and vega in year *t-1*, scaled by vega in year *t-1*, is larger than 10%.
Delta Increase	Binary variable that takes the value of 1 if the difference between delta in year *t* and delta in year *t-1*, scaled by delta in year *t-1*, is larger than 10%.
	Panel B: Acquisition Variables
Acquisitions	Binary variable that takes the value of 1 if the firm announced at least one acquisition in year *t*, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Acquisition Investments	It is the sum of the announced acquisition deal values in year *t* scaled by firm's sales in year *t-1*. Deal values are from Thomson Financial SDC, firm's sales are from COMPUSTAT.

Increased Bidder Ret. Vol. Acq. Investments	It is the sum of the deal values of acquisitions of bidding firms announced in year *t* scaled by firm's sales in year *t-1*, whose return volatility increased over the period 1 day to 60 days following the acquisition effective date relative to 120 days to 60 days prior to the acquisition announcement date. Deal values are from Thomson Financial SDC, firm's sales are from COMPUSTAT.
Large Acquisition Investments	It is the sum of deal values of bidding firms that announced acquisitions in year *t*, whose value is more than 5% of the firm's sales in year *t-1*, 0 otherwise. Deal values are from Thomson Financial SDC, firm's sales are from COMPUSTAT.
Private Acquisition Investments	It is the sum of the announced private acquisition deal values in year *t* scaled by firm's sales in year *t-1*. Deal values are from Thomson Financial SDC, firm's sales are from COMPUSTAT.
Diversifying Acquisition Investments	It is the sum of the announced diversifying acquisition deal values in year *t* scaled by firm's sales in year *t-1*. Deal values are from Thomson Financial SDC, firm's sales are from COMPUSTAT. Diversifying Acquisition is based on the 4-digit SIC Code of target and bidding firms. The variable is created using data from Thomson Financial SDC.
Bidder CARs (-2, +2)	Cumulative abnormal return for the bidding firm in the 5-day event window (-2, +2) where 0 is the announcement day. The returns are calculated using the market model with the market model parameters estimated over the period starting 240 days and ending 41 days prior to the announcement. CRSP value-weighted index return is the market return.
Bidder CARs (-30, -3)	Cumulative abnormal return for the bidding firm in pre-announcement period (-30, -3) where 0 is the announcement day. The returns are calculated using the market model with the market model parameters estimated over the period starting 240 days and ending 41 days prior to the announcement. CRSP value-weighted index return is the market return.
Ln (MV)	The natural logarithm of bidder market value of equity 4 weeks prior to the acquisition announcement from CRSP in US$ million. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator.
Stock	Binary variable that takes the value of 1 for deals where the method of payment is 100% stock, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Cash	Binary variable that takes the value of 1 for deals where the method of payment is 100% cash, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Public	Binary variable that takes the value of 1 if the target firm is a public firm, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Private	Binary variable that takes the value of 1 if the target firm is a private firm, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Relative Size	It is the ratio between the deal value and the market capitalization of the acquiring firm 30 days prior to the acquisition announcement. Deal value is from Thomson Financial SDC, market capitalization is from CRSP.
Diversifying	Binary variable that takes the value of 1 if the target firm operates in a different 4-digit SIC industry to the one of the bidder, 0 otherwise. The variable is created using data from Thomson Financial SDC.

Completed	Binary variable that takes the value of 1 if the deal is completed, 0 otherwise. The variable is created using data from Thomson Financial SDC.
Hostile	Binary variable that takes the value of 1 for deals defined as "hostile" or "unsolicited" by Thomson Financial SDC, 0 otherwise.
Return Volatility	It is the standard deviation of daily stock returns.
Excess Return Volatility	It is the standard deviation of daily stock excess returns, where excess return is the difference of the firm stock return and the CRSP value-weighted index return.
M&A Liquidity	Sum of acquisitions value for each year and Fama-French 49 industry classification divided by the total assets of all COMPUSTAT firms in the same Fama-French 49 industry classification and year.
Annualized Return Volatility	It is the annualized standard deviation of bidder stock returns over the year prior to the acquisition.
	Panel C: Control Variables
Size	Log of Sales. Sales represent firm's total sales in the fiscal year from COMPUSTAT.
B/M	It is firm book value of equity divided by market value of equity at the fiscal year-end from COMPUSTAT.
Cash Reserves	It is defined as firm cash and short-term investments divided by the book value of total assets at the fiscal year-end from COMPUSTAT.
Leverage	It is defined as firm total financial debt (long-term debt plus debt in current liabilities) divided by the book value of total assets at the fiscal year-end from COMPUSTAT.
Cash Flows	It is defined as (operating income before depreciation minus interest expenses minus taxes minus preferred dividends minus common dividends) scaled by the book value of total assets in the fiscal year from COMPUSTAT.
CAPEX	It is firm's capital expenditures in the fiscal year, scaled by total assets from COMPUSTAT.
Annualized Excess Return Volatility	It is the annualized standard deviation of firm stock excess returns in the calendar year, where excess return is the difference between the firm stock return and the CRSP value-weighted index return.
EBITDA/Interest Expenses	It is the interest coverage ratio, calculated as EBITDA divided by interest expenses in the fiscal year from COMPUSTAT.
Abnormal Return	Buy-and-hold excess stock return over the calendar year defined as $\Pi(1 + R_{i,m}) - \Pi(1 + R_{p,m})$, where $R_{i,m}$ and $R_{p,m}$ are the return for firm *i* and the return of the benchmark portfolio for month *m*, respectively. Benchmark portfolios are the twenty-five Fama-French value-weighted portfolios based on size and book-to-market.
Overconfidence	Overconfidence is a binary variable that takes the value of 1 when the CEO is identified as overconfident, 0 otherwise. A CEO is overconfident if she postpones the exercise of vested options that are at least 67% in the money. Overconfidence is measured for every sample year. Firstly, for each CEO-year, the total realizable value of the options is divided by the number of options held by the CEO to determine the average realizable value per option. The strike price is calculated as the fiscal year-end stock price minus

	the average realizable value. The average moneyness of the options is then calculated as the stock price divided by the estimated strike price minus one. Only the vested options held by the CEO are included in the computation. The variable is created using data from ExecuCompp.
Female	Binary variable that takes the value of 1 if the CEO is female, 0 otherwise. The variable is created from the field "Gender" in ExecuCompp.
CEO Age	It is the age of the CEO from ExecuCompp.
CEO Tenure	It is the difference between year *t* and the year in which the CEO is appointed from ExecuCompp.
Entrenchment Index	Bebchuk et al. (2009) Entrenchment Index from RiskMetrics. The index is the sum of binary variables concerning the following provisions: 1) Classified boards; 2) Limitations to shareholders' ability to amend the bylaws; 3) Supermajority voting for business combinations; 4) Supermajority requirements for charter amendments; 5) Poison pills; and 6) Golden parachutes.
Independent Directors	Percentage of independent directors. It is the ratio between the number of independent directors, and the board size from RiskMetrics.
DCS	Binary variable that takes the value of 1 if the firm is a dual-class shares firm, 0 otherwise. The variable is created using data from RiskMetrics.
CEO/Chairman	Binary variable that takes the value of 1 if the roles of CEO and Chairman of the board are not split, 0 otherwise. The variable is created using data from RiskMetrics.
Board Size	Number of directors composing the board of directors from RiskMetrics.

Appendix B

Variables Correlation Matrix

This Appendix presents pairwise Pearson correlations of the variables used in the analysis. All variables are defined in Appendix A.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Cash Compensation	1.00															
2. Delta	0.25	1.00														
3. Vega	0.46	0.32	1.00													
4. B/M	-0.06	-0.12	-0.08	1.00												
5. Cash Reserves	-0.13	0.06	-0.05	-0.17	1.00											
6. Leverage	0.11	-0.04	0.04	-0.02	-0.37	1.00										
7. Cash Flows	0.07	0.08	0.07	-0.12	-0.09	-0.19	1.00									
8. Size	0.46	0.23	0.48	-0.02	-0.13	0.08	0.03	1.00								
9. Female	-0.03	-0.03	-0.01	0.02	0.04	-0.02	0.00	0.00	1.00							
10. CEO Tenure	0.12	0.11	0.04	0.04	-0.13	0.03	0.01	0.07	-0.06	1.00						
11. CEO Age	0.03	0.23	0.02	0.00	0.03	-0.05	0.05	-0.06	-0.04	0.40	1.00					
12. Overconfidence	0.03	0.17	-0.15	-0.20	0.09	-0.09	0.14	-0.07	-0.02	0.00	0.06	1.00				
13. Entrenchment Index	-0.07	-0.15	-0.03	0.08	-0.11	0.04	-0.02	-0.10	0.01	-0.02	-0.09	-0.10	1.00			
14. DCS	0.02	0.08	-0.01	0.02	-0.02	0.01	0.02	0.00	0.01	0.04	0.11	0.02	-0.16	1.00		
15. Independent Directors	-0.01	-0.14	0.10	0.04	-0.02	0.03	-0.04	0.12	0.03	-0.03	-0.14	-0.13	0.27	-0.19	1.00	
16. CEO/Chairman	0.21	0.14	0.18	0.00	-0.13	0.07	0.05	0.16	-0.04	0.27	0.26	-0.04	0.02	-0.03	0.08	1.00
17. Board Size	0.32	0.08	0.27	0.03	-0.31	0.16	-0.10	0.38	-0.04	0.11	-0.08	-0.07	0.09	0.00	0.08	0.11
18. Ann. Excess Ret. Volatility	-0.22	-0.08	-0.20	0.04	0.28	-0.03	-0.23	-0.19	0.03	-0.14	-0.03	-0.02	-0.02	0.00	-0.15	-0.12
19. CAPEX	-0.05	0.02	-0.05	-0.05	-0.12	0.02	0.29	-0.03	-0.02	-0.03	0.02	0.09	-0.03	-0.03	-0.10	0.01
20. EBITDA/Int. Expenses	-0.07	0.05	-0.03	-0.09	0.26	-0.30	0.21	-0.07	0.01	-0.03	0.06	0.08	-0.04	0.02	-0.05	-0.04
21. Abnormal Return	0.06	0.09	-0.03	-0.25	0.12	-0.09	0.13	-0.04	-0.01	-0.02	0.01	0.25	-0.10	0.00	-0.04	-0.04
22. M&A Liquidity	-0.04	0.03	-0.02	-0.09	0.10	-0.03	0.07	-0.08	-0.01	-0.06	0.00	0.08	-0.08	0.00	-0.12	-0.02

	17.	18.	19.	20.	21.	22.
17. Board Size	1.00					
18. Ann. Excess Return Volatility	-0.30	1.00				
19. CAPEX	-0.07	0.06	1.00			
20. EBITDA/Interest Expenses	-0.16	0.01	0.04	1.00		
21. Abnormal Return	-0.03	-0.06	0.01	0.07	1.00	
22. M&A Liquidity	-0.13	0.15	0.10	0.03	0.05	1.00

Table 1

Descriptive Statistics on CEO Compensation, Acquisitions and Firm and Other CEO Characteristics

The table presents the descriptive statistics on CEO compensation, acquisitions and firm and other CEO characteristics for the universe of US publicly listed firms with data on ExecuComp over the period 1996-2010. Panel A reports the mean, median and standard deviation for CEO compensation and wealth. Panel B reports the statistics for firm and CEO characteristics used in the empirical analysis. Panel C reports statistics for the acquisition variables. See Appendix A for definitions of the variables. N denotes the number of observations. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator.

Panel A: Compensation Variables	**Mean**	**Median**	**Std. Dev**	**N**
Total Compensation ($ 1,000)	4,693.16	2,599.72	6,134.97	28,332
Cash Compensation ($ 1,000)	1,265.87	887.49	1,223.48	28,332
Equity Compensation ($ 1,000)	3,427.29	1,472.09	5,353.78	28,332
Option Compensation ($ 1,000)	2,311.24	696.52	4,511.85	19,063
CEO Wealth ($ 1,000)	66,279.80	12,655.06	195,768.10	26,772
Stock Portfolio ($ 1,000)	53,294.75	6,387.14	181,079.60	26,820
Option Portfolio ($ 1,000)	11,120.13	2,276.96	24,882.47	27,974
Vega ($ 1,000)	130.27	46.65	227.16	28,332
Delta ($ 1,000)	842.01	234.40	2,096.95	26,834
Panel B: Firm and CEO Characteristics				
Size ($ 1,000,000)	4,387.03	1,178.63	9,140.71	28,256
B/M	0.5392	0.4604	0.5296	24,358
Cash Reserves	0.1456	0.0710	0.1742	28,262
Leverage	0.2288	0.2068	0.1949	28,157
Cash Flows	0.0704	0.0742	0.0907	28,270
Overconfidence	0.4669	0.0000	0.4989	28,310
Female	0.0201	0.0000	0.1404	28,332
CEO Tenure	6.6935	5.0000	6.8983	26,943
CEO Age	55.4218	55.0000	7.2977	26,488
Entrenchment Index	2.4507	2.0000	1.3870	22,061
DCS	0.0878	0.0000	0.2830	22,061
Independent Directors	0.6870	0.7143	0.16926	19,645
CEO/Chairman	0.6139	1.0000	0.4869	19,645
Board Size	9.5131	9.0000	2.6902	19,645
Annualized Return Volatility	0.4243	0.3649	0.2337	27,397
EBITDA/Interest Expenses	57.0343	8.4325	209.2367	22,956
CAPEX	0.0518	0.0364	0.0532	27,171
Abnormal Return	0.0401	0.0171	0.0729	28,293
Panel C: Acquisition Variables				
Acquisition Investment in US$ million	117.9303	0.0000	486.352	28,332
Acquisition Investment (Sum of Deal Values/Sales)	0.074262	0.0000	0.276447	28,208
Acquisitions Dummy	0.228399	0.0000	0.419808	28,332
M&A Liquidity	-0.0404	-0.0666	0.5912	28,332
Relative Size	0.1149	0.0338	0.2246	9,446
Diversifying	0.3418	0.0000	0.4743	9,615
Completed	0.9198	1.0000	0.2716	9,615
Hostile	0.0130	0.0000	0.1133	9,615
Public	0.2155	0.0000	0.4112	9,615
Private	0.7845	1.0000	0.4112	9,615
Stock	18.7556	0.0000	36.3149	9,615
Cash	45.87794	30.628	46.74625	9,615

Table 2

Change in Bidder Risk

The table presents bidder means and medians for the standard deviation of daily stock returns and daily excess returns computed during four event periods: 1) the pre-announcement period, which covers 120 days to 60 days prior to the acquisition announcement date; 2) the announcement period, which is from 30 days prior to 30 days following the acquisition announcement; 3) the post-announcement period, which covers 60 days to 120 days following the acquisition announcement date; and 4) the post effective date period, which is from 1 to 60 days after the day the acquisition becomes effective. Mean and median differences between post-announcement and pre-announcement periods, between announcement and pre-announcement periods, and between post-effective date and pre-announcement periods standard deviations are also reported. Excess return is defined as the difference between bidder stock return and the CRSP value-weighted index return. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively for the t-test of differences between means (Mean) and the Wilcoxon rank sum test for differences between the respective distributions (Median). N denotes the number of observations.

	Pre Announcement (1)		Announcement Period (2)		Post Announcement (3)		Post Effective Date (4)	
	Return Volatility	Excess Return Volatility	Return Volatility	Excess Return Volatility	Return Volatility	Excess Return Volatility	Return Volatility	Excess Return Volatility
Mean	2.620%	2.3545%	2.7044%	2.4100%	2.7047%	2.4107%	2.7316%	2.4222%
Median	2.2717%	2.0216%	2.3022%	2.0405%	2.2973%	2.0376%	2.2868%	2.0225%
N	9,592	9,592	9,592	9,592	9,592	9,592	8,771	8,771

	Difference (3) – (1)		Difference (2) – (1)		Difference (4) – (1)	
	Return Volatility	Excess Return Volatility	Return Volatility	Excess Return Volatility	Return Volatility	Excess Return Volatility
Mean	0.0757%***	0.0562%***	0.0754%***	0.0555%***	0.1116%***	0.0677%***
Median	0.0057%***	0.0142%***	0.0085%***	0.0140%***	0.0151%***	0.0009%**
N	9,592	9,592	9,592	9,592	8,771	8,771

Table 3

Risk-Taking Incentives and Acquisition Investments

The table presents in specification (1) the estimates of a pooled tobit regression with clustered standard errors at firm level where the dependent variable is the sum of the deal values of acquisition investments made in a given year scaled by sales in the previous year. Specification (2) presents the estimates of a pooled probit regression with clustered standard errors at firm level where the dependent variable takes the value of one if a firm made an acquisition in a given year, and zero otherwise. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments (Tobit)	**Acquisitions (Probit)**
	(1)	**(2)**
Constant	-0.6670***	-1.5120***
	[0.2337]	[0.3525]
Vega	0.1139***	0.1647**
	[0.0413]	[0.0747]
Delta	0.0135***	0.0127
	[0.0051]	[0.0079]
Size	0.0043	0.0769***
	[0.0087]	[0.0152]
B/M	-0.0478***	-0.0729***
	[0.0163]	[0.0258]
Cash Reserves	0.0709	-0.0614
	[0.0648]	[0.1025]
Leverage	-0.0302	-0.1345
	[0.0508]	[0.0836]
Cash Flows	0.3752***	0.9663***
	[0.1094]	[0.1584]
Overconfidence	0.0636***	0.1049***
	[0.0150]	[0.0251]
Cash Compensation	0.0492***	0.0671**
	[0.0160]	[0.0267]
Female	-0.0040	-0.0613
	[0.0675]	[0.0964]
CEO Tenure	-0.0016	0.0004
	[0.0014]	[0.0022]
CEO Age	-0.0051***	-0.0070***
	[0.0014]	[0.0022]
Abnormal Return	0.0700***	0.0615***
	[0.0138]	[0.0192]
M&A Liquidity	0.0639	-0.0196
	[0.1085]	[0.1677]
Year & Industry FE	yes	yes
Pseudo R^2	0.0630	0.0667
Observations	21,289	21,289

Table 4

Risk-Taking Incentives and Acquisition Investments by CEO Confidence Level

The table presents the estimates of pooled tobit regressions with clustered standard errors at firm level where the dependent variable is the sum of the deal values of acquisition investments made in a given year scaled by sales in the previous year. In specification (1) the overall sample is used in the analysis. In specifications (2) and (3) we partition the sample by overconfident and non-overconfident CEOs. The definition for overconfidence, as well as for all other variables, is in appendix A. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments (Tobit)		
	All (1)	**Overconfident (2)**	**Non-Overconfident (3)**
Constant	-0.6849***	-0.4925*	-0.8247***
	[0.2329]	[0.2542]	[0.2782]
Vega	0.1819***	-0.0035	0.1494***
	[0.0446]	[0.0667]	[0.0450]
Delta	0.0062	0.0196***	0.0030
	[0.0071]	[0.0061]	[0.0071]
Vega*Overconfidence	-0.1860***		
	[0.0635]		
Delta*Overconfidence	0.0111		
	[0.0082]		
Size	0.0028	-0.0019	0.0024
	[0.0087]	[0.0128]	[0.0095]
B/M	-0.0464***	-0.0659**	-0.0435**
	[0.0163]	[0.0309]	[0.0176]
Cash Reserves	0.0704	0.1014	0.0387
	[0.0647]	[0.0855]	[0.0819]
Leverage	-0.0277	0.0998	-0.1448**
	[0.0506]	[0.0743]	[0.0579]
Cash Flows	0.3741***	0.0547	0.6521***
	[0.1094]	[0.1655]	[0.1318]
Overconfidence	0.0797***		
	[0.0169]		
Cash Compensation	0.0523***	0.0589***	0.0553***
	[0.0158]	[0.0223]	[0.0184]
Female	-0.0046	-0.0306	-0.0125
	[0.0679]	[0.1200]	[0.0781]
CEO Tenure	-0.0017	-0.0031*	-0.0002
	[0.0014]	[0.0019]	[0.0015]
CEO Age	-0.0051***	-0.0057***	-0.0041***
	[0.0014]	[0.0019]	[0.0016]
Abnormal Return	0.0693***	0.0864***	0.0341*
	[0.0138]	[0.0192]	[0.0184]
M&A Liquidity	0.0610	0.0167	0.0743
	[0.1085]	[0.1585]	[0.1394]
Year & Industry FE	yes	yes	yes
Pseudo R^2	0.0635	0.0607	0.0673
Observations	21,289	9,318	11,971

Table 5

Risk-Taking Incentives and Acquisition Investments: The Role of Corporate Governance

The table presents the estimates of pooled tobit regressions with clustered standard errors at firm level where the dependent variable is the sum of the deal values of all acquisition investments made in a given year scaled by sales in the previous year. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments (Tobit)		
	(1)	(2)	(3)
Constant	-0.6628***	-0.5130**	-0.5197**
	[0.2454]	[0.2575]	[0.2548]
Vega	0.1031*	0.2718*	0.4941**
	[0.0619]	[0.1586]	[0.2009]
Delta	0.0113	0.0125	0.0235
	[0.0078]	[0.0156]	[0.0241]
Vega*Entrenchment Index	-0.0085	-0.0158	-0.0189
	[0.0221]	[0.0225]	[0.0222]
Delta*Entrenchment Index	-0.0014	-0.0016	-0.0012
	[0.0032]	[0.0032]	[0.0032]
Vega*Indep. Directors		-0.2263	-0.2311
		[0.2107]	[0.2063]
Delta*Indep. Directors		-0.0032	-0.0096
		[0.0247]	[0.0245]
Vega*DCS			-0.2068*
			[0.1253]
Delta*DCS			-0.0134
			[0.0107]
Vega*Board Size			-0.0099
			[0.0124]
Delta*Board Size			0.0001
			[0.0018]
Vega*CEO/Chairman			-0.1213*
			[0.0692]
Delta*CEO/Chairman			-0.0075
			[0.0093]
Size	0.0135	0.0066	0.0042
	[0.0082]	[0.0084]	[0.0090]
B/M	-0.0537***	-0.0861***	-0.0844***
	[0.0168]	[0.0209]	[0.0209]
Cash Reserves	0.0653	0.0584	0.0526
	[0.0662]	[0.0678]	[0.0680]
Leverage	-0.0481	-0.0124	-0.0170
	[0.0498]	[0.0533]	[0.0532]
Cash Flows	0.3507***	0.1917	0.1843
	[0.1132]	[0.1285]	[0.1294]
Overconfidence	0.0589***	0.0564***	0.0565***
	[0.0146]	[0.0150]	[0.0150]
Cash Compensation	0.0563***	0.0588***	0.0559***
	[0.0152]	[0.0157]	[0.0155]
Female	-0.0291	-0.0563	-0.0621
	[0.0638]	[0.0706]	[0.0689]
CEO Tenure	-0.0015	-0.0026**	-0.0031**
	[0.0013]	[0.0013]	[0.0013]
CEO Age	-0.0050***	-0.0045***	-0.0046***
	[0.0013]	[0.0013]	[0.0013]
Abnormal Return	0.0373***	0.0475***	0.0490***
	[0.0135]	[0.0147]	[0.0147]
M&A Liquidity	-0.0178	-0.0240	-0.0285
	[0.1154]	[0.1167]	[0.1172]
Entrenchment Index	0.0130*	0.0079	0.0078
	[0.0071]	[0.0076]	[0.0077]
Independent Directors		0.0035	0.0072
		[0.0627]	[0.0630]
DCS			0.0482
			[0.0394]
CEO/Chairman			0.0025
			[0.0047]
Board Size			0.0380*
			[0.0196]
Year & Industry FE	yes	yes	yes
Pseudo R^2	0.0663	0.0672	0.0683
Observations	17,594	15,345	15,345

Table 6

Predicted and Residual Vega and Delta

The table presents the estimates of pooled tobit regressions with clustered standard errors at firm level where the dependent variable is the sum of the deal values of all acquisition investments made in a given year scaled by sales in the previous year. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. Predicted and residual lagged vega and delta are the predicted values and residuals from regressions of vega and delta on endogenous and control variables shown in Table 3. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments (Tobit)	
	(1)	(2)
Constant	0.1401	5.6382***
	[0.2894]	[0.6505]
Predicted Vega	0.7576***	6.4658***
	[0.2295]	[0.8054]
Residual Vega		-0.7481***
		[0.1550]
Predicted Delta	0.0670***	0.2591***
	[0.0211]	[0.0783]
Residual Delta		-0.1488***
		[0.0179]
Size	-0.0586***	-0.4961***
	[0.0174]	[0.0482]
B/M	-0.0130	0.1908***
	[0.0191]	[0.0349]
Cash Reserves	0.2414***	0.3082***
	[0.0730]	[0.0706]
Leverage	0.0331	0.5542***
	[0.0574]	[0.0940]
Cash Flows	0.6769***	1.3462***
	[0.1218]	[0.1456]
Overconfidence	0.0557***	0.0465***
	[0.0152]	[0.0147]
Cash Compensation	0.0018	-0.3942***
	[0.0224]	[0.0507]
Female	-0.0130	-0.0105
	[0.0703]	[0.0681]
CEO Tenure	-0.0056***	-0.0276***
	[0.0021]	[0.0052]
CEO Age	-0.0049***	-0.0048***
	[0.0014]	[0.0013]
Abnormal Return	0.0552***	0.0630***
	[0.0140]	[0.0144]
M&A Liquidity	-0.0703	-0.0987
	[0.1175]	[0.1194]
Year & Industry FE	yes	yes
Pseudo R^2	0.0696	0.0784
Observations	17,797	17,797

Table 7

Systems of Simultaneous Equations

The table presents the estimates of systems of simultaneous equations running 3SLS regressions where the dependent variable is the sum of the deal values of all acquisition investments made in a given year scaled by sales in the previous year and the jointly determined variables are the acquisition investments, vega and delta. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are contemporaneous. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments	Vega	Delta
	(1)	(2)	(3)
Constant	0.7296***	-0.7475***	-3.7600***
	[0.0294]	[0.0169]	[0.1450]
Acquisition Investments		0.4159***	6.9570***
		[0.0289]	[0.2952]
Vega	0.6991***		-1.1081***
	[0.0319]		[0.1995]
Delta	0.0580***	0.0072***	
	[0.0042]	[0.0021]	
Size	-0.0776***	0.0603***	0.5629***
	[0.0026]	[0.0016]	[0.0202]
B/M	0.0430***	-0.0279***	-0.4124***
	[0.0042]	[0.0030]	[0.0324]
Cash Reserves	-0.0019		
	[0.0129]		
Leverage	0.1397***	-0.0678***	-1.2855***
	[0.0115]	[0.0089]	[0.0889]
Cash Flows	0.0389*	-0.1056***	
	[0.0219]	[0.0199]	
Overconfidence	0.0195***		
	[0.0049]		
Cash Compensation	-0.0348***	0.0654***	
	[0.0036]	[0.0026]	
Female	0.0042		
	[0.0108]		
CEO Tenure	-0.0048***		0.0765***
	[0.0004]		[0.0023]
CEO Age	-0.0005**		
	[0.0002]		
Abnormal Return	0.0027		
	[0.0028]		
M&A Liquidity	0.0867***		
	[0.0213]		
CAPEX		-0.0592**	0.3806
		[0.0261]	[0.2587]
Annualized Excess Ret. Volatility		-0.0085	0.1859***
		[0.0065]	[0.0654]
EBITDA/Interest Expenses		0.0103	
		[0.0067]	
Year & Industry FE	yes	yes	yes
Observations	17,797	17,797	17,797

Table 8

Impact of Unobserved Confounding Variables

The table present the analysis for the impact of unobserved confounding variables. For the main control variable (vega) an impact statistic is calculated (ITCV) indicating the minimum impact of a confounding variable that would be needed to render the coefficient statistically insignificant. The ITCV is defined as the product of the correlation between the x-variable (i.e., vega) and the confounding variable and the correlation between the y-variable (i.e., acquisition investments) and the confounding variable. To assess the likelihood that such a variable exists, column (2) shows the impact of each independent variable on the coefficient of vega. The impact is defined as the product of the partial correlation between the x-variable (i.e., vega) and the control variable and the correlation between the y-variable (acquisition investments) and the control variable (partialling out the effect of the other control variables). Column (3) shows a more conservative measure of impact, which is the product of the simple correlation between the x-variable and the control variable and the simple correlation between the y-variable and the control variable.

	ITCV	Impact	$\text{Impact}_{\text{Raw}}$
	(1)	(2)	(3)
Vega	0.0145		
Delta		0.0160	0.0171
Size		-0.0226	-0.0470
B/M		0.0014	0.0062
Cash Reserves		0.0058	-0.0049
Leverage		-0.0004	-0.0008
Cash Flows		0.0001	-0.0012
Overconfidence		-0.0046	-0.0081
Cash compensation		0.0101	-0.0060
Female		0.0000	-0.0001
CEO Tenure		0.0000	-0.0002
CEO Age		0.0008	-0.0035
Abnormal Return		-0.0010	-0.0018
M&A Liquidity		0.0008	-0.0008

Table 9

Increase in Risk-Taking Incentives and Acquisition Investments

The table presents in specification (1) the estimates of a pooled tobit regression with clustered standard errors at firm level where the dependent variable is the sum of the deal values of all acquisition investments made in a given year scaled by sales in the previous year. Specification (2) presents the estimates of a pooled probit regression with clustered standard errors at firm level where the dependent variable takes the value of one if a firm made an acquisition in a given year, and zero otherwise. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisition Investments (Tobit)	**Acquisitions (Probit)**
	(1)	**(2)**
Constant	-0.8273***	-1.7254***
	[0.2325]	[0.3572]
Vega Increase	0.0496***	0.0719***
	[0.0127]	[0.0216]
Delta Increase	0.0286*	0.0415*
	[0.0151]	[0.0244]
Size	0.0211***	0.1004***
	[0.0081]	[0.0148]
B/M	-0.0407**	-0.0616**
	[0.0162]	[0.0274]
Cash Reserves	0.0665	-0.0856
	[0.0676]	[0.1094]
Leverage	-0.0541	-0.1737*
	[0.0524]	[0.0902]
Cash Flows	0.5368***	1.1285***
	[0.1161]	[0.1738]
Overconfidence	0.0609***	0.1041***
	[0.0154]	[0.0267]
Cash Compensation	0.0504***	0.0635**
	[0.0166]	[0.0279]
Female	-0.0264	-0.0917
	[0.0658]	[0.1048]
CEO Tenure	0.0001	0.0022
	[0.0013]	[0.0023]
CEO Age	-0.0043***	-0.0059**
	[0.0014]	[0.0024]
Abnormal Return	0.0481***	0.0455**
	[0.0154]	[0.0223]
M&A Liquidity	-0.0462	-0.1380
	[0.1146]	[0.1788]
Year & Industry FE	yes	yes
Pseudo R^2	0.0646	0.0693
Observations	18,265	18,265

Table 10

Risk-Taking Incentives and Risky Acquisition Investments

The table presents the estimates of pooled tobit regressions with clustered standard errors at firm level where the dependent variable is the sum of the deal values of: i) acquisition investments with increased bidder return volatility; ii) large acquisition investments; iii) private acquisition investments; and iv) diversifying acquisition investments. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisitions Investments (Tobit)			
	Increased Bidder Return Volatility	Large	Private	Diversifying
	(1)	(2)	(3)	(4)
Constant	-0.7106***	-0.8423***	-0.3616***	-0.7058***
	[0.1294]	[0.3180]	[0.1066]	[0.1664]
Vega	0.0842***	0.1311*	0.0693***	0.1038***
	[0.0325]	[0.0679]	[0.0242]	[0.0320]
Delta	0.0084**	0.0227***	0.0088***	0.0093**
	[0.0033]	[0.0072]	[0.0030]	[0.0039]
Size	0.0109	-0.0820***	-0.0126**	0.0099
	[0.0071]	[0.0131]	[0.0052]	[0.0072]
B/M	-0.0078	-0.0586**	-0.0209**	-0.0431***
	[0.0139]	[0.0249]	[0.0100]	[0.0132]
Cash Reserves	-0.0246	0.0897	0.0058	-0.0434
	[0.0507]	[0.0925]	[0.0393]	[0.0531]
Leverage	-0.0247	0.0431	-0.0019	-0.0557
	[0.0413]	[0.0761]	[0.0309]	[0.0417]
Cash Flows	0.3344***	0.7325***	0.2171***	0.2085**
	[0.0858]	[0.1574]	[0.0628]	[0.0861]
Overconfidence	0.0242*	0.0930***	0.0412***	0.0488***
	[0.0128]	[0.0233]	[0.0092]	[0.0124]
Cash Compensation	0.0143	0.0924***	0.0188*	0.0270**
	[0.0130]	[0.0239]	[0.0096]	[0.0132]
Female	0.0029	0.0195	0.0021	0.0011
	[0.0467]	[0.0972]	[0.0390]	[0.0577]
CEO Tenure	-0.0007	-0.0044**	-0.0005	-0.0022**
	[0.0011]	[0.0021]	[0.0008]	[0.0011]
CEO Age	-0.0020*	-0.0068***	-0.0024***	-0.0012
	[0.0011]	[0.0021]	[0.0008]	[0.0011]
Abnormal Return	0.0695***	0.0899***	0.0415***	0.0462***
	[0.0108]	[0.0204]	[0.0083]	[0.0112]
M&A Liquidity	0.1800*	0.1505	0.1171*	0.0043
	[0.0934]	[0.1603]	[0.0646]	[0.0996]
Year & Industry FE	yes	yes	yes	yes
Pseudo R^2	0.0892	0.0667	0.0736	0.0763
Observations	21,289	21,289	21,289	21,289

Table 11

Within Firm Results

The table presents the estimates of a logit regression with firm fixed effects and clustered standard errors at firm level where the dependent variable takes the value of one if a firm made an acquisition in a given year, and zero otherwise. This analysis includes firm and year fixed effects. The sample period is between January 1, 1997 and December 31, 2011 for the universe of US publicly listed firms with data on ExecuComp. See Appendix A for definitions of the variables. All independent variables are lagged with respect to the dependent variable. All variables are winsorized at the 1% on both tails, with the exception of binary variables. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Acquisitions (Logit)
Vega	0.2699*
	[0.1436]
Delta	0.0072
	[0.0165]
Size	-0.1422**
	[0.0608]
B/M	-0.3535***
	[0.0697]
Cash Reserves	1.8309***
	[0.2522]
Leverage	-1.7321***
	[0.2190]
Cash Flows	2.9649***
	[0.4109]
Overconfidence	0.1039**
	[0.0508]
Cash Compensation	0.0932*
	[0.0508]
Female	-0.2829
	[0.2486]
CEO Tenure	-0.0074
	[0.0059]
CEO Age	-0.0057
	[0.0052]
Abnormal Return	0.0046
	[0.0401]
M&A Liquidity	-0.1472
	[0.3736]
Firm and Year FE	yes
Pseudo R^2	0.0393
Observations	15,100

Table 12

Risk-Taking Incentives and Bidder 5-day CARs

The table presents the estimates of OLS regressions with clustered standard errors at firm level of bidder 5-day cumulative abnormal returns (CARs) over the event window (-2, +2) around the acquisition announcement over the period between January 1, 1997 and December 31, 2011 on vega and other control characteristics for the universe of US publicly listed bidding firms with data on ExecuComp. See Appendix A for definitions of the variables. All variables are winsorized at the 1% on both tails. Dollar values are stated in 2005 dollars using the World Bank's consumer price index deflator. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. Heteroskedasticity-robust clustered standard errors at firm level are reported in brackets. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Bidder 5-day CARs	**(1)**	**(2)**	**(3)**
Constant	0.0426**	0.0521***	0.0522***
	[0.0194]	[0.0197]	[0.0199]
Vega	0.0072**	0.0083**	0.0085**
	[0.0030]	[0.0037]	[0.0043]
Delta	0.0004	0.0001	-0.0001
	[0.0003]	[0.0004]	[0.0006]
Vega*Public		0.0004	0.0004
		[0.0071]	[0.0072]
Delta*Public		0.0016***	0.0016***
		[0.0006]	[0.0006]
Vega*Overconfidence			-0.0001
			[0.0056]
Delta*Overconfidence			0.0001
			[0.0006]
Ln (MV)	-0.0031***	-0.0036***	-0.0036***
	[0.0007]	[0.0008]	[0.0008]
B/M	-0.0009	-0.0021	-0.0021
	[0.0037]	[0.0040]	[0.0040]
Cash Reserves	-0.0146**	-0.0126	-0.0126
	[0.0073]	[0.0078]	[0.0078]
Leverage	-0.0020	-0.0049	-0.0049
	[0.0062]	[0.0067]	[0.0067]
Relative Size	-0.0093	-0.0109*	-0.0109*
	[0.0058]	[0.0062]	[0.0062]
Diversifying	0.0019	0.0027	0.0027
	[0.0017]	[0.0018]	[0.0018]
Completed	0.0053*	0.0049	0.0049
	[0.0031]	[0.0033]	[0.0033]
Hostile	-0.0009	-0.0012	-0.0012
	[0.0071]	[0.0072]	[0.0072]
Public	-0.0157***	-0.0191***	-0.0191***
	[0.0023]	[0.0032]	[0.0032]
Annualized Return Volatility	-0.0591	-0.1118	-0.1120
	[0.1192]	[0.1249]	[0.1249]
Cash Flows	0.0106	0.0135	0.0135
	[0.0155]	[0.0161]	[0.0161]
CEO Age	-0.0001	-0.0001	-0.0001
	[0.0001]	[0.0001]	[0.0001]
Overconfidence	0.0013	0.0010	0.0009
	[0.0018]	[0.0018]	[0.0021]
Stock	-0.0081**	-0.0092**	-0.0092**
	[0.0040]	[0.0041]	[0.0041]
Bidder CAR (-30, -3)	-0.0077	-0.0081	-0.0081
	[0.0083]	[0.0088]	[0.0088]
M&A Liquidity	-0.0349***	-0.0314**	-0.0314**
	[0.0121]	[0.0124]	[0.0124]
Year and Industry FE	yes	yes	yes
Adjusted R^2	0.0275	0.0301	0.0298
Observations	6,982	6,285	6,285